

REMARKS

Claims 1-3 are pending in this application, of which claims 1 and 3 have been amended. No new claims have been added.

The Examiner has requested that the specification, Abstract and claims be checked for the presence of minor errors. Such errors have been corrected in the aforementioned amendments.

Claims 1 and 3 stand rejected under 35 USC §102(b) as anticipated by U.S. Patent 5,206,571 to Burri (hereafter "**Burri**").

Applicants respectfully traverse this rejection.

Burri discloses a stepper motor 10 including a six pole pair rotor 11 rotatable about an output shaft 12 acting as the rotor axis. A stator ring 14 of the motor 10 carries a four phase winding made up of windings 15 and 16. The motor is controlled by a stepper motor controller 17 which generates currents at its outputs 18 and 19, 181 and 191 in response to a pulse train 101 received at its input 102. Outputs 18 and 19 are respectively connected to stator windings 15 and 16 so that the currents generated excite the coils to drive the motor 10 in response to the input 101. Power is supplied to the arrangement by power supply connection 100 of controller 17. The rotation of the motor 11 is limited by a wiper 103, which is rigidly connected to output shaft 12, impinging upon an end stop 104.

The Examiner has cited column 4, lines 13-17 for teaching a "detecting coil provided separately from the exciting coils so as to generate induction voltage according to rotation of the rotor", as recited in claims 1 and 3 of the instant application.

Applicant respectfully disagrees. No such detecting coil is shown in the drawings or

disclosed in the specification, and the cited passage merely discloses a means included in the motor controller 17 for "detecting an oscillatory winding current as indicative of rotation". Please verify our understanding that such means is shown in the circuit diagram of FIG. 4 of **Burri**, and does not include a separate detecting coil provided separately from the exciting coils, as claimed in the present invention.

Thus, the 35 USC §102(b) rejection should be withdrawn.

The Examiner has indicated that claim 2 would be allowable if rewritten in independent form. Applicant respectfully defers such action until a FINAL Office Action, if any, is received.

In view of the aforementioned amendments and accompanying remarks, claims 1-3, as amended, are in condition for allowance, which action, at an early date, is requested.

Attached hereto is a marked-up version of the changes made to the specification and claims by the current amendment. The attached page is captioned "**VERSION WITH MARKINGS TO SHOW CHANGES MADE**".

If, for any reason, it is felt that this application is not now in condition for allowance, the Examiner is requested to contact Applicant's undersigned attorney at the telephone number indicated below to arrange for an interview to expedite the disposition of this case.

09/826,359

In the event that this paper is not timely filed, Applicant respectfully petitions for an appropriate extension of time. The fees for such an extension or any other fees which may be due with respect to this paper, may be charged to Deposit Account No. 01-2340.

Respectfully Submitted,

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PATENT TRADEMARK OFFICE

Enclosures: Version with markings to show changes made
Substitute Abstract of the Disclosure

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IN THE ABSTRACT:

Please amend the Abstract as follows:

A stepping motor [is provided,] which includes: exciting coils; a rotor provided with a plurality of N/S poles so as to rotate following a change of an excitation state of the exciting coils; and a detecting coil provided separately from the exciting coils so as to generate induction voltage according to rotation of the rotor. [And, a] A driving apparatus including the stepping motor is provided, which further includes: a driven member linked with the rotor; a stopper to mechanically stop the driven member at a predetermined position; a first exciting means to normally or reversely rotate the rotor by controlling the excitation state of the exciting coils; a second exciting means to reverse the rotor in a direction of making the driven member move toward the predetermined position by controlling the excitation state of the exciting coils; a position detecting means to detect the driven member having abutted the stopper and stopped at the predetermined position on a basis of induction voltage generated in the detecting coil during control by the second exciting means; and a controlling means which stops the first exciting means controlling and starts the second exciting means controlling when an instruction signal is inputted, and which starts the first exciting means controlling and stops the second exciting means controlling when the position detecting means detects the driven member having stopped at the predetermined position.

IN THE SPECIFICATION:

Please amend the specification as follows:

Paragraph beginning at line 21 of page 1 has been amended as follows:

Hereinafter, a relation between an excitation state of the exciting coils 1a1, 1a2 and rotation of the rotor 1b is described with reference to FIGS. 6A-6H. First, in an excitation state regulated at excitation step S1, that is, the b-side of the exciting coil 1a2 becomes [an] a non-excited state and the exciting coil 1a2 becomes the S pole, the N pole of the rotor 1b is attracted toward the a-side of the exciting coil 1a1, and the rotor 1b becomes stable.

Paragraph beginning at line 15 of page 2 has been amended as follows:

[And when] When the excitation state of excitation step S8 is generated again from excitation step S1, the rotor 1b rotates again by 9 degrees in the arrow Y1 direction and becomes stable. Like the above, the rotor 1b turns by 9 degrees every step in the arrow Y1 direction by repeatedly controlling the excitation state of the exciting coils 1a1, 1a2 according to the excitation pattern consisting of the excitation steps S8 to S1.

Paragraph beginning at line 21 of page 2 has been amended as follows:

[And, in] In order to rotate the rotor 1b in an arrow Y2 direction, the excitation state of the exciting coils 1a1, 1a2 is controlled according to a pattern [reverse to] opposite the above excitation pattern, i.e., from S1 toward S8, whereby the pointer 2 shifts in an arrow Y4 direction

(FIG. 5).

Paragraph beginning at line 25 of page 2 has been amended as follows:

Next, an operation of the above indicating apparatus used for a vehicle-speedometer, for example, is described hereinafter. An angle data D1 is supplied to the drive controller 4, which angle data D1 shows a rotation angle of the rotor 1b corresponding to a travel which is a difference between a target position of the pointer 2 and a present position thereof. The target position of the pointer 2 is calculated on the basis of speed information from a speed sensor. [And, by] By means of the drive controller 4 controlling an excitation state of the exciting coils 1a1, 1a2 according to this angle data D1, the pointer 2 shifts by only the above travel and indicates the target position.

Paragraph beginning at line 9 of page 3 has been amended as follows:

With respect to the above indicating apparatus, however, a power swing caused by an input of the angle data D1 affected by vibration and noise of the vehicle body could be brought about, wherein an actual travel of the pointer 2 differs from the target travel of the pointer 2. [And, if] If the power swing is repeated, a difference arises between the speed indicated by the pointer 2 and the speed information from the speed sensor, whereby the indicating apparatus can not carry out an accurate indication.

Paragraph beginning at line 6 of page 4 has been amended as follows:

[And, because] Because the excitation state of the exciting coils 1a1, 1a2 is continuously controlled even though the pointer 2 has fully returned to the stopper 5, the pointer 2 repeats abutting and leaving the stopper 5, thereby making an unpleasant clattering noise.

Paragraph beginning at line 10 of page 4 has been amended as follows:

In order to solve the above problem, the indicating apparatus which closes the reset operation simultaneously with the abutment of the pointer 2 against the stopper 5 is proposed. That is, because an induction voltage is generated in the exciting coil 1a1 or 1a2 being in a non-excited state while the pointer 2 is not in contact with the stopper 5 and therefore the rotor 1b is moving, and, on the other hand, because an induction voltage is not generated in the exciting coil being in a non-excited state while the pointer 2 is in contact with the stopper 5 and, therefore, the rotor 1b is stopping, the voltage generated in either, being in the non-excited state, of the exciting coils can be detected at a timing of the exciting coil being controlled into the non-excited state.

Paragraph beginning at line 20 of page 4 has been amended as follows:

[And, whether] Whether or not the induction voltage has been generated is judged, and if yes, movement of the pointer 2 is stopped on a judgment that the pointer 2 has abutted the stopper 5.

Paragraph beginning at line 25 of page 4 has been amended as follows:

[And, the] The rotor 1b is continuously controlled to reverse in the state that the pointer 2

is in contact with the stopper 5, the rotor 1b sometimes normally rotates at a timing of the exciting coils 1a1, 1a2 being changed to the proper excited states.

Paragraph beginning at line 7 of page 6 has been amended as follows:

According to the present invention with the first aspect, because the detecting coil is provided [besides] in addition to the exciting coils, the presence or absence of induction voltage generated in the detecting coil can be detected at each excitation step. Therefore, because whether or not the rotor is turning or stopping can be judged, the abutment of the driven member against the stopper can be securely detected.

Paragraph beginning at line 16 of page 6 has been amended as follows:

According to the present invention with the second aspect, because the detecting coil is provided at a center of a longest peripheral surface between adjoining exciting coils, the detecting coil can be prevented from receiving an influence from the excitation state of the exciting coils, thereby further securely ensuring [to detect] detection of the abutment of the driven member against the stopper.

Paragraph beginning at line 14 of page 7 has been amended as follows:

According to the present invention with the third aspect, in the stepping motor, the rotor provided with a plurality of N/S poles rotates following a change of an excitation state of the exciting coils, and the detecting coil provided separately from the exciting coils generates an

induction voltage according to rotating of the rotor. [And, the] The stopper mechanically stops the driven member at a predetermined position. [And also] In addition, the first exciting means normally or reversely rotates the rotor by controlling the excitation state of the exciting coils. Further, the second exciting means reverses the rotor in a direction of making the driven member move toward the predetermined position by controlling the excitation state of the exciting coils.

Paragraph beginning at line 23 of page 7 has been amended as follows:

The position detecting means detects the driven member having abutted the stopper and stopped at the predetermined position on a basis of induction voltage generated in the detecting coil during control by the second exciting means. [And, the] The controlling means stops the first exciting means controlling and starts the second exciting means controlling when an instruction signal is inputted, and also starts the first exciting means controlling and stops the second exciting means controlling when the position detecting means detects the driven member having stopped at the predetermined position.

Paragraph beginning at line 6 of page 8 has been amended as follows:

Therefore, because the detecting coil is provided [besides] in addition to the exciting coils, the presence or absence of an induction voltage generated in the detecting coil can be detected at each excitation stop. Therefore, because whether or not the rotor is turning or stopping can be judged, the abutment of the driven member against the stopper can be securely detected in the driving apparatus.

Paragraph beginning at line 16 of page 8 has been amended as follows:

FIG. 1 is a [schema] diagram showing an embodiment of a stopping motor of the present invention;

FIG. 2 is a [schema] diagram showing an indicating apparatus as a driving apparatus in which the stepping motor of FIG. 1 is mounted;

FIG. 3 is a circuit diagram showing a drive controller of the indicating apparatus of FIG. 2;

FIG. 4 is a timing chart of excitation pulses outputted from a second excitation circuit of FIG. 3;

FIG. 5 is a [schema] diagram showing a prior art indicating apparatus as the driving apparatus in which a conventional stepping motor is mounted; and

FIGS. 6A-6H are [schemata] diagrams each showing a relation between an excitation state of the exciting coils and rotation of the rotor.

Paragraph beginning at line 7 of page 9 has been amended as follows:

FIG. 1 is a [schema] diagram showing an embodiment of a stepping motor for the present invention. The stepping motor 1 has exciting coils 1a1, 1a2 wound [up on] upon a stator 1d, a rotor 1b on which five sets of N/S poles are magnetized in turn and which rotates following a change of an excitation state of the exciting coils 1a1, 1a2, and detecting coil 1c in which induction voltage is generated according to rotation of the rotor 1b.

Paragraph beginning at line 1 of page 10 has been amended as follows:

As shown in FIG. 4, the above excitation pulses P11-P14 have different phases from each other so that the rotor 1b can turn by 9 degrees per one step. By inputting the excitation pulses P11-P14 to the a-side and the b-side of the exciting coil 1a2 and to the b-side and the a-side of the exciting coil 1a1, the excitation state of the exciting coils 1a1, 1a2 changes correspondingly to excitation steps S8 to S1 as shown in FIG. 4, and the rotor 1b reverses following the change of the excitation state.

Paragraph beginning at line 15 of page 10 has been amended as follows:

The drive controller 4 further has a control circuit 4e (a controlling means), which stops the control by the first excitation circuit 4a when an instruction signal S3 outputted at the timing of the ignition ON/OFF, the connection with the vehicle-mounted battery, or the like, is inputted and starts the control by the second excitation circuit 4b, and which starts the control by the first excitation circuit 4a when the position detection circuit 4d detects the stopping of the pointer 2 at the zero position with abutting the stopper 5 and stops the control by the second excitation circuit 4b.

Paragraph beginning at line 4 of page 11 has been amended as follows:

[And, the] The control circuit 4e makes the second excitation circuit 4b output the excitation pulses P11-P14 to start the control of the exciting coils 1a1, 1a2. When the excitation pulses P11-P14 are inputted, the exciting coils 1a1, 1a2 are excited according to excitation steps

shown in FIG. 4, whereby the rotor 1b reverses every 9 degrees. [And, the] The pointer 2 is shifted toward the stopper 5.

Paragraph beginning at line 18 of page 11 has been amended as follows:

[And, the] The control circuit 4e stops outputting the rejection signal according to this detection signal, whereby the control by the first excitation circuit 4a is started, the output of the excitation pulses P11-P14 from the second excitation circuit 4b is stopped, and the control by the second excitation circuit 4b is stopped, thereby stopping the reset operation.

Paragraph beginning at line 3 of page 12 has been amended as follows:

[And, as] As shown in FIG. 1, the exciting coils 1a1, 1a2 are provided along the peripheral surface of the rotor 1b at an angle of 90 degrees (not shown) to each other. [And, the] The detecting coil 1c is provided along the longer peripheral surface between the exciting coils 1a1, 1a2 at the center thereof.

Paragraph beginning at line 7 of page 12 has been amended as follows:

In case that [the] more than two exciting coils [more than two] are provided, the detecting coil 1c is provided along the longest peripheral surface, at the center thereof, between the adjoining two exciting coils.

IN THE CLAIMS:

Please amend claims 1 and 3 as follows:

1. (Amended) A stepping motor, comprising:

exciting coils;

a rotor provided with a plurality of N/S poles so as to rotate following a change of an excitation state of the exciting coils; and

a detecting coil provided separately from the exciting coils so as to generate an induction voltage according to rotation of the rotor.

3. (Amended) A driving apparatus, comprising:

a stepping motor having:

exciting coils[,] ;

a rotor providing with a plurality of N/S poles so as to rotate following a change of an excitation state of the exciting coils[,] ; and

a detecting coil provided separately from the exciting coils so as to generate induction voltage according to rotation of the rotor;

a driven member linked with the rotor;

a stopper [to] for mechanically [stop] stopping the driven member at a predetermined position;

a first exciting means to normally or reversely rotate the rotor by controlling the

excitation state of the exciting coils;

a second exciting means [to reverse] for reversing the rotor in a direction of making the driven member move toward the predetermined position by controlling the excitation state of the exciting coils;

a position detecting means [to detect] for detecting the driven member having abutted the stopper and stopped at the predetermined position on a basis of induction voltage generated in the detecting coil during control by the second exciting means; and

a controlling means [which stops] for stopping the first exciting means controlling and [starts] starting the second exciting means controlling when an instruction signal is inputted, and [which starts] for starting the first exciting means controlling and [stops] stopping the second exciting means controlling when the position detecting means detects the driven member having stopped at the predetermined position.